

## Redox Reactions: a way to produce energy

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The module covers oxidation-reduction reactions, known as redox. After a first general introduction to the reactions, their use both in daily living and in the laboratory is illustrated, suggesting a simple experiment. Furthermore, the use of redox for the creation of batteries, starting from Volta's, is presented. Exercises help to teach new concepts concerning chemistry and stimulate the use of the English language by introducing new words, improving grammar and favouring oral and written appropriateness in the management of discourse.

### Subtitles

<b>AECLIL Partner</b>	Rete CLIL di Pavia, I.I.S. Faravelli, Stradella, Italy
<b>Topic</b>	Redox reactions
<b>Subject area</b>	Chemistry
<b>Language</b>	English
<b>Language Level</b>	A2 and above
<b>Target group</b>	15/16-year-old students, Computer Studies College
<b>Time</b>	12 hours
<b>Aims</b>	<p><i>Content and social skills:</i></p> <ul style="list-style-type: none"> <li>- ability to distinguish redox reactions from other types of reactions</li> <li>- ability to distinguish one type of redox reaction from other types of redox reactions (e.g. combustion and corrosion are redox reactions but they have different characteristics)</li> <li>- ability to identify oxidant and reduction agents</li> <li>- ability to balance redox reactions</li> <li>- ability to recognize existing relations between chemical reactions and electrical energy</li> <li>- ability to perform basic laboratory activities</li> </ul> <p><i>Language skills: development of</i></p> <ul style="list-style-type: none"> <li>- the abilities of listening, reading, writing and speaking</li> <li>- the appropriate scientific vocabulary</li> </ul>

<b>Products/outcomes</b>	written report of the experiment with a final brief oral report in English
<b>Classroom activities</b>	<ul style="list-style-type: none"> <li>- teacher's speech</li> <li>- power point presentation</li> <li>- group and individual activities (both written and in the laboratory)</li> <li>- audio/video listening</li> </ul>
<b>Assessment tools</b>	<ul style="list-style-type: none"> <li>- written report</li> <li>- final written test</li> <li>- laboratory experiment</li> <li>- assessment grid</li> </ul>
<b>Assessment criteria</b> <b>Content</b> <b>Language</b> <b>Cooperative work</b>	<ul style="list-style-type: none"> <li>- <i>content and cooperative work</i>: knowledge of given topics, ability to work out concepts and rework formulae, problem solving</li> <li>- <i>language</i>: appropriateness, correctness, richness in vocabulary</li> </ul>
<b>Resources</b>	<ul style="list-style-type: none"> <li>- power point file</li> <li>- conceptual map</li> <li>- questionnaires</li> <li>- worksheets</li> <li>- internet</li> <li>- video</li> <li>- text</li> </ul>

## Activities

### Lesson 1

#### *Students' work*

Students are introduced to the topic thanks to a power point presentation. At first they are given a sheet containing the key words to understand the content, which teachers will explain and make clear. After that they are required to take notes directly from the projected file according to the teachers' further explanations. The file first provides examples of redox phenomena as observed in real-life situations (e.g.: rust, decay, corrosion, combustion, biological processes). These examples are also explained by the help of pictures. There are also play-on-words and pictures to teach the basic concepts. Reduction and oxidation are then explained in a more technical way through formulae. Hints for balancing them are also given. Students listen to the presentation, take notes and interact with teachers by asking questions when concepts are not clearly understood. Only English will be accepted

as the language of interaction, in order to improve and stimulate the use of vocabulary and linguistic fluency on the topic.

In the end, students are given a conceptual map to fill in.

**Resources**

- worksheet 1: *Redox Key Words*
- power point file: *Redox Reactions*
- worksheet 2: *Conceptual Map*

**Assessment**

- evaluation of conversational skills through interaction

## Lesson 2

**Students' work**

After revising the notes taken, students are asked to fill in a questionnaire with open answers on the contents in the power point file. Answers are then discussed in class and further explanation is provided, when required. Interaction with teachers is stimulated by correcting and self-correcting mistakes both about the content and the language used in discussion.

**Resources**

- students' notes
- worksheet 3: *Questionnaire*

**Assessment**

- filled-in questionnaire
- direct observation of communicative skills in student-teacher interaction
- understanding content

## Lesson 3

**Students' work**

Students are given practical examples of redox balancing, which are first explained by the teacher on the blackboard and with the use of the Periodic Table of Elements. Note-taking activity is once again stimulated and student-teacher interaction promoted. In the end students are given a worksheet to practice balancing through a series of possible reactions to develop by assigning oxidation numbers and balancing reactions.

**Resources**

- *Periodic Table of Elements*
- worksheet 4: *Redox Exercises*
- blackboard

## Lesson 4

### *Students' work*

Students are shown a video of a laboratory experiment dealing with an example of a redox reaction. A glossary of the main tools used in a chemistry laboratory activity is given so as to allow teachers to refer to these tools in English without misunderstanding on the part of students. Pronunciation is pointed out and practiced. Discussion on the images shown is promoted in English only.

### *Resources*

- video: *Redox Demo*
- worksheet 5: *Lab Tools Glossary*

### *Assessment*

- direct observation on listening comprehension
- pronunciation appropriateness
- communicative skills

## Lesson 5

### *Students' work*

Laboratory reproduction of the experiment previously viewed in the video. Students are divided into groups chosen by the teachers according to their attitude, basic knowledge and technical ability in the lab. The experiment is reproduced under the supervision of the teachers to ensure safe use of materials and the respect of the procedures.

After that students are asked to write a report in English on their experience and to work on a brief oral exposition of laboratory work:

### *Resources*

- Video: *Redox Demo*
- Chemistry Lab.

### *Assessment*

- direct observation of group work and task performance
- language skills: speaking, writing

## Lesson 6

### *Students' work*

A text is provided for reading comprehension activities. Students get information on a famous example of the practical exploitation of redox reactions in the creation of a battery. Volta's pile is described and details about its functioning are given. In

addition, students are given materials about Volta's life experience and his knowledge of chemical processes. Discussion on the topics provided is once more encouraged after the proposal of a text to evaluate correct comprehension of the materials examined.

**Resources**

- text: *Volta's Pile*
- worksheet 6: *Reading Comprehension*

**Assessment**

- language skill: reading
- filled-in questionnaire (ref. worksheet 6)

## Lesson 7

**Students' work**

At this stage students are asked to complete a final test based on knowledge acquired both as far as the contents explained are concerned and their practical ability to deal with chemical reaction balancing.

**Resources**

- worksheet 7: *Final test*
- worksheet 8: *Assessment grid* (see below)

**Assessment**

- evaluation on knowledge acquired and its application to given situations
- language skills: reading, writing

## Lesson 8

**Students' work**

Corrected papers are redistributed to students and the most common mistakes underlined and analysed through a checklist on the blackboard. Students are stimulated to ask questions on individual mistakes, when needed. A final discussion about the experience is promoted during which students are asked about their impressions of the whole experience.

**Resources**

- students' final tests
- blackboard
- worksheet 8: *Analytic assessment grid for content, language and cooperative work* (see below)

**Assessment**

- evaluation of conversational skills through interaction

Analytic assessment grid for content, language and cooperative work

	Criteria	5 excellent	4 good	3 satisfactory	2 almost satisfactory	1 unsatisfactory	Score
C O N T E N T	Use of basic subject concepts and knowledge (what)	Has acquired all the basic concepts and principles of the topic. Well structured, correct and comprehensive explanation; excellent personal evaluation	Has acquired most of the basic concepts and principles of the topic. Generally well structured, correct and adequate explanation; good personal evaluation .	Has acquired some basic concepts and principles of the topic. Sufficient explanation, with a limited number of errors; limited personal evaluation.	Has acquired only a few basic concepts and principles of the topic. The explanation shows major deficiencies in terms of logical structuring and formulation.	Hasn't acquired any of the basic concepts and principles of the topic. The explanation is severely deficient in terms of logical structuring and formulation; no personal evaluation.	
	Application of knowledge to new situations (how it relates)	Has used new knowledge with confidence and creativity, applying it in an original way.	Has used new knowledge and applied it correctly in new situations.	Has used new basic concepts and applied them in simple situations.	Has used a few simple concepts and applied them when guided.	Hasn't achieved any knowledge.	
	Creativity/evaluation	Has shown critical thinking, creativity and initiative.	Has shown a good level of creativity and evaluation capability.	Has shown sufficient evaluation capability and sometimes original ideas.	Has not always shown sufficient evaluation ability and has presented poor creativity.	Has shown inability to evaluate and very poor creativity.	
L A N G U A G E	Use of language - listening - speaking - reading - writing - interaction	Consistent grammatical control and appropriate use of vocabulary. Can express him/herself with a natural flow and interact with ease.	Good grammatical control and generally appropriate use of vocabulary. Can express him/herself and interact with a good degree of fluency.	A few mistakes in grammar and vocabulary use do not lead to misunderstanding. Can express him/herself and interact with a reasonable degree of fluency.	Systematically makes mistakes in grammar and vocabulary use but the message is generally clear. Can manage the discourse and the interaction with effort and must be helped.	Systematic grammar mistakes and the narrow range of vocabulary makes the message meaningless. Communication is totally dependent on repetition, rephrasing and repair.	
	Cooperative work	Original and creative.	Good level of interaction.	Sufficient degree of interaction.	Partial cooperation.	Unable to work in group.	

Reflection and comments

The CLIL experience has provided good results concerning both English and chemistry. The topic, the redox, sometimes seems to be difficult for students who find it hard to remember and rework it. The use of English, with the support of multimedia, has made it "more attractive" for students, who have approached it with curiosity and interest. In this sense, the experience in the lab has contributed very much; the students have felt satisfied with what they could understand, and they were able to reproduce the experience given in the video. From the point of view of language, the results have been very satisfactory as well; the students have been able to approach English not only as a foreign language to be learnt but also as a means of communication, trying to improve both their expressive capabilities and grammar appropriateness, as well as to expand their vocabulary.

## Bibliography

Crippa M., Nepgen D., 2010: *Al centro della chimica*, Le Monnier Scuola.

Brady J.E., Holum J.R., 1992: *Chimica*, Zanichelli.

*Alessandro Volta* ([http://en.wikipedia.org/wiki/Alessandro\\_Volta](http://en.wikipedia.org/wiki/Alessandro_Volta)).

*Chemguide* (<http://www.chemguide.co.uk/inorganic/redox/definitions.html>)

*Collection of resources* created by Peggy Lawson, a classroom teacher from Oxbow Prairie Heights School, Souris Moose Mountain School Division No. 122 (now the South East Cornerstone School Division No. 209)

([http://www.saskschools.ca/curr\\_content/chem30\\_05/6\\_redox/redox1\\_1.htm](http://www.saskschools.ca/curr_content/chem30_05/6_redox/redox1_1.htm)).

*GSC Chemistry Notes*

([http://www.files.chem.vt.edu/RVGS/ACT/notes/oxidation\\_numbers.html](http://www.files.chem.vt.edu/RVGS/ACT/notes/oxidation_numbers.html)).

*Science clarified* (<http://www.scienceclarified.com/Oi-Ph/Oxidation-Reduction-Reaction.html>)

*ScienceGeek.net*

([http://www.sciencegeek.net/APchemistry/Presentations/4\\_Redox/index.html](http://www.sciencegeek.net/APchemistry/Presentations/4_Redox/index.html))

*Redox* (<http://en.wikipedia.org/wiki/Redox>).

*Redox Demo* (video, <http://www.youtube.com/watch?v=zg-gsLEGk2A&feature=fvst>).